

Analyze Business Models for Implementation and Operation of a Statewide GNSS-RTN

Task 4 Report: Existing Infrastructure

Prepared by

Ahmed Al-Kaisy, Ph.D., PE – Professor & Program Manager

ORCID: 0000-0003-1198-0975

Rafael Teixeira, EIT – Graduate Research Assistant

ORCID: 0000-0003-4314-0962

of the
Western Transportation Institute
College of Engineering
Montana State University
Bozeman, MT 59717-4250

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ACRONYMS AND ABBREVIATIONS

CORS – Continuously Operating Reference Station

GAGE – Geodetic Facility for the Advancement of Geoscience

GNSS – Global Navigation Satellite System

MTSRN – Montana State Reference Network

NAVSTAR – Navigation Satellite Timing & Ranging

NCN – NOAA/NGS CORS Network

NGS – National Geodetic Survey

NOAA – National Oceanic and Atmospheric Administration

RTK – Real-Time Kinematic

RTN – Real-Time Network

UNAVCO – University NAVSTAR Consortium

WSRN – Washington State Reference Network

1 INTRODUCTION

This task aims to document all existing infrastructure used in providing GNSS-RTN geospatial location service in the state of Montana. Such documentation is deemed important as the existing infrastructure has the potential and is expected to contribute to the future Montana statewide GNSS-RTN system.

This report presents the current status of the CORSs infrastructure in Montana and provides much relevant information about those stations such as the current hosting arrangements, public and private networks that receive and correct data from CORSs, and station ownership, among other characteristics. Further, out-of-state CORSs currently used to improve location precision in areas near state boundaries are also discussed in this report.

2 MONTANA CORS INFRASTRUCTURE

This task identified a total of 62 CORSs within the geographic boundaries of the state of Montana. The stations vary in ownership, networks they contribute to, sampling rate, power source, and means of communication. **Figure 1** shows a map with Montana CORS locations. Further, location coordinates along with the mounting type for all CORSs in Montana are provided in Appendix A (1).

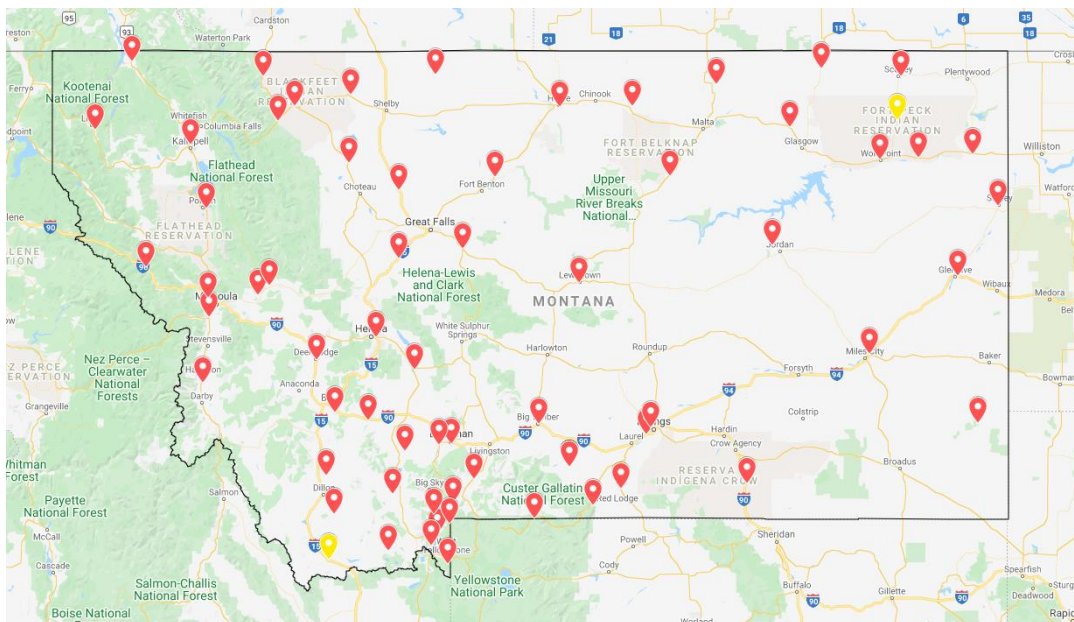


Figure 1. CORSs in the State of Montana

2.1 Montana CORSs by Network

Montana CORSs are part of different networks, both public and private, providing GNSS location services in Montana. Stations are not limited to being a part of a single network, as many CORSs contribute to multiple networks. Maps of the major GNSS networks along with a list of the contributing CORSs for each respective network are provided in Appendix B.

The Montana State Reference Network (MTSRN) is a Pilot network currently hosted by the Washington State Reference Network (WSRN). The MTSRN is the largest public network in Montana; currently consisting of 54 CORSs covering different parts of the state – other 7 CORS are to be added to the network in the spring of 2022. All the raw geospatial data collected by the CORSs in the MTSRN are sent to the WSRN central processing facility, where the data is corrected and sent back to the MTSRN users. The users of this public network have access to static files of any station in the network as well as real-time correction services (2).

The post-processed data or static files are available for any user to download at no expense. Real-time kinematics (RTK) corrected data, both single base and network, are available for authorized users and possible partners interested in joining the network. Authorized users have access to RTK single base corrections from any station in the network and to RTK network corrections for areas in which subnetworks are present, such as the Fort Peck and Blackfeet areas. Other public networks include the National Oceanic and Atmospheric Administration (NOAA) Continuously Operating Reference Stations (CORSs) Network (NCN), hosted by the NOAA/National Geodetic Survey (NGS) (3). Currently, NGS manages data from around 1900 CORSs located within the US and the UNAVCO network, provided by the Geodetic Facility for the Advancement of Geosciences (GAGE). Funded by the National Science Foundation and NASA, The UNAVCO network currently manages thousands of stations both within and outside the US (4). Post-processed data corrections are available for users of the NCN and the UNAVCO networks. Users of the latter network also have access to real-time GNSS data corrections.

Besides the public networks discussed above, private networks are also used to provide GNSS location services in Montana. Specifically, TopNet Live (5), SmartNet North America (6), and Trimble VRS network (7) are the major private networks providing location services in Montana. These networks are hosted by the manufacturers TopCon, Leica, and Trimble, respectively. The network provided by Trimble is the largest private network in Montana with a total of 47 CORSs (8). The services provided by these networks are subscription-based and

network users usually have access to post-processed as well as real-time GNSS data corrections. **Table 1** includes all CORSs in Montana and the major networks they contribute to, namely: MTSRN, NGS, UNAVCO (9), and Trimble. For the TopCon Live and SmartNet North America, no information was available on Montana CORSs that are part of these networks, and therefore these networks were not included in **Table 1**. Further, **Table 1** also includes five stations in the MTSRN network that are located outside Montana (North Dakota, Wyoming, and Idaho) but contribute to the MTSRN network; and seven stations that will be added in the MTSRN in the spring of 2022.

2.2 Montana CORSs by Ownership

Currently, 57 CORSs are publicly owned in Montana, which constitute most CORSs in the state. For the vast majority of stations, the location was determined using accurate location coordinates. However, for a couple of stations, the location coordinates were not available and therefore the map location for those stations was estimated (shown in yellow in **Figure 1**). **Table 1** shows the names and ownership types (public or private) for Montana CORSs.

2.3 Montana CORSs by Sampling Rate

The sampling rate is another property that indicates the frequency with which the receiver is collecting data. Currently, most of the CORSs in Montana provide a sampling rate of 15 seconds or less; with a considerable number of stations providing a sampling rate of 1 second. **Table 2** lists the CORSs in Montana providing location name and sampling rate in seconds. Out of the 49 CORSs with known sampling rates in this table, 27 operate with a sampling rate of one second, 20 with a sampling rate of 15 seconds, and one station each with a sampling rate of 5 seconds and 30 seconds.

Figure 2 shows a map of Montana CORSs with known sampling rates. The CORSs are marked in light green, light blue, yellow, and orange for sampling rates of 1 second, 5 seconds, 15 seconds, and 30 seconds respectively.

Table 1. CORs by Network Affiliation

Station	Location	Network				Station	Location	Network			
		MTSRN	NGS	UNAVCO	Trimble			MTSRN	NGS	UNAVCO	Trimble
HAML	Hamilton, MT	•	•		•	P046	Clearwater Junct., MT	•	•	•	•
LOLO	Lolo, MT	•	•		•	P047	East Glacier, MT	•	•	•	•
MSOL	Missoula Airport, MT	•	•			P048	Four Corners, MT	•		•	•
MTBR	Bridger, MT	•	•		•	P049	Armington Junct., MT	•	•	•	•
MTCB	Culbertson, MT	•	•		•	P050	Sweat Grass Hills, MT	•	•	•	•
MTCU	Cut Bank, MT	•	•		•	P051	Billings Airport, MT	•	•	•	•
MTDT	Helena, MT	•	•		•	P052	Jordan, MT	•	•	•	•
<u>MTEI</u>	Billings, MT	•	•			P053	Whitewater, MT	•	•	•	•
MTFV	Flathead Valley CC, MT	•	•		•	P054	Ekalaka, MT		•	•	•
MTGW	Glasgow, MT	•	•		•	P055	Glendive, MT	•	•	•	•
MTHC	Butte, MT	•	•		•	P456	W. Yellowstone, MT			•	•
MTHM	Harlem, MT	•	•		•	<u>p457</u>	Big Sky, MT			•	•
MTLG	Lodge Grass, MT	•	•		•	P458	W. Yellowstone, MT			•	•
MTLO	Loma, MT	•	•		•	P460	Big Sky, MT	•		•	•
MTLW	Lewistown, MT	•	•		•	P461	Merriman, MT	•		•	•
MTMS	MSU N. Havre, MT	•	•		•	P680	W. Yellowstone, MT			•	•
MTOP	Opheim, MT	•	•		•	P706	Dillon, MT	•	•	•	•
MTPJ	Pendroy Junct., MT	•	•		•	P707	Red Rock Lakes, MT		•	•	•
<u>MTRC</u>	Sidney, MT	•	•		•	<u>P712</u>	W. Yellowstone, MT			•	•
MTSU	MSU Bozeman, MT	•	•			<u>P714</u>	Gardiner, MT			•	•

Private stations are underlined

Table 2. CORs by Network Affiliation - Continued

Station	Location	Network				Station	Location	Network			
		MTSRN	NGS	UNAVCO	Trimble			MTSRN	NGS	UNAVCO	Trimble
MTSY	Scobey, MT	•	•		•	P719	Ennis, MT	•		•	•
MTUM	Sunset, MT	•	•			P721	Silver Gate, MT			•	•
MTWP	Wolf Point, MT	•	•		•	P722	Fishtail, MT		•	•	•
MTZM	Zoteman, MT	•	•		•	P818	Fishtail, MT			•	•
MTMI	Miles City, MT		•		•	P819	Fishtail, MT			•	•
NOMT	Norris, MT	•	•	•	•	MAWY	Mammoth, WY	•		•	
BKFB	Browning, MT	•				RYA1	East Hope, ID	•			
FTPP	Popular, MT	•				NDGR	Grenora, ND	•			
MTPO	Fort Peck RES.,MT	•				P024	Sunset Peak, ID	•		•	
YBRA	Red lodge, MT			•		P025	Bonnors Ferry, ID	•		•	
BUEH	Lima, MT			•		STMY	<i>St. Mary, MT</i>	•			
LCLN	Lincoln, MT	•				CSCD	<i>Cascade, MT</i>	•			
TWSD	Townsend, MT	•				DUTN	<i>Dutton, MT</i>	•			
DRLG	Deer Lodge, MT	•				LBBY	<i>Libby, MT</i>	•			
WTHL	Whitehall, MT	•				PLSN	<i>Polson, MT</i>	•			
EUKA	Eureka, MT	•				SUPR	<i>Superior, MT</i>	•			
P045	Dillon, MT	•	•	•	•	BTMR	<i>Big Timber, MT</i>	•			

Private stations are underlined

Stations to be added are presented in italic

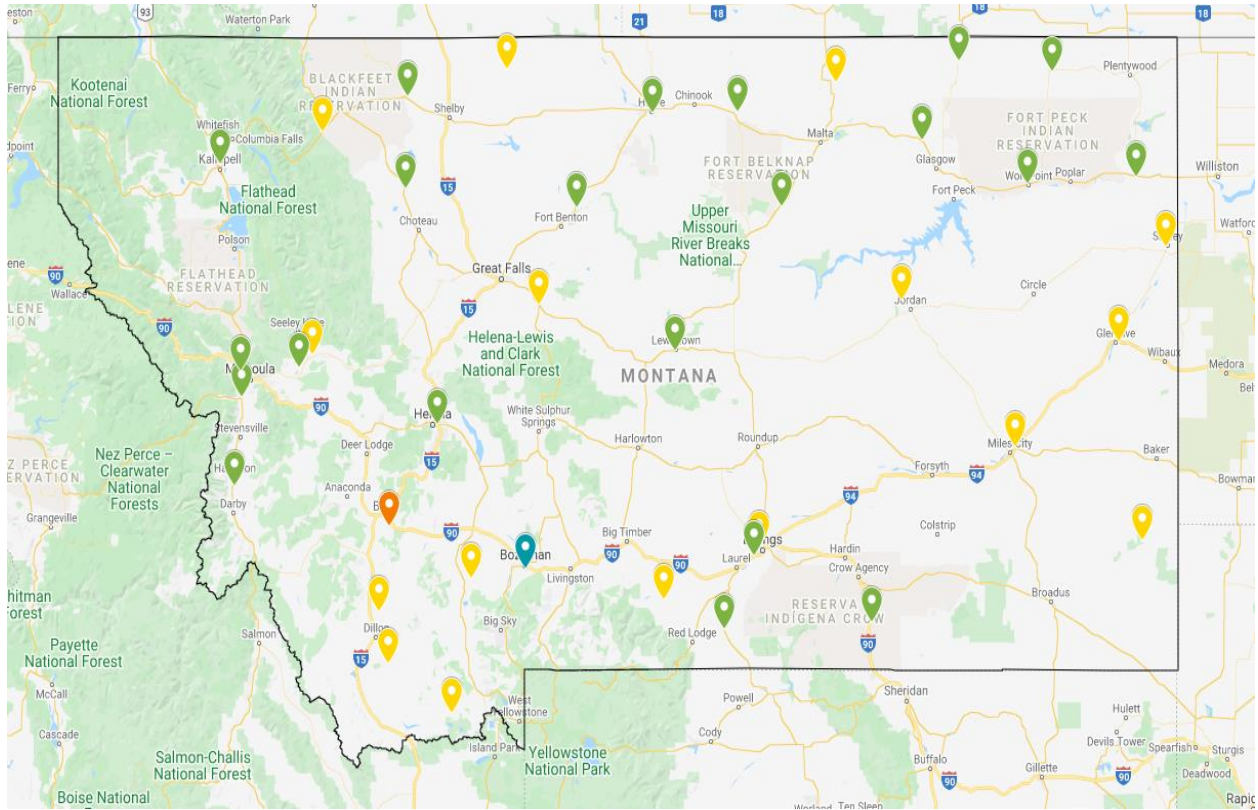


Figure 2. Montana CORSs with Known Sampling Rate

2.4 Montana CORSs by Communication Type

The communication between CORSs and the central processing facility is often achieved using either the internet or mobile cellular networks depending on availability and cost in different areas of the state. This information is unavailable for many Montana CORSs and is only known for part of the MTSRN network stations. Specifically, this information is available for 28 out of the 54 CORSs comprising the MTSRN network. For the 28 CORSs with known communication type, 15 CORSs (around 54%) use mobile cellular networks while the remaining 13 CORSs use the internet as a means of communication with the central processing facility. **Figure 3** shows the breakdown of the MTSRN CORSs by communication type for stations with available information.

Table 3. Montana CORSSs with Respective Sampling Rate

Station	Location	Sampling Rate	Station	Location	Sampling Rate
HAML	Hamilton, MT	1 sec	P046	Clearwater Junct., MT	15 sec
LOLO	Lolo, MT	1 sec	P047	East Glacier, MT	15 sec
MSOL	Missoula Airport, MT	1 sec	P048	Four Corners, MT	--
MTBR	Bridger, MT	1 sec	P049	Armington Junct., MT	15 sec
MTCB	Culbertson, MT	1 sec	P050	Sweat Grass Hills, MT	15 sec
MTCU	Cut Bank, MT	1 sec	P051	Billings Airport, MT	15 sec
MTDT	Helena, MT	1 sec	P052	Jordan, MT	15 sec
<u>MTEI</u>	Billings, MT	1 sec	P053	Whitewater, MT	15 sec
MTFV	Flathead Valley CC, MT	1 sec	P054	Ekalka, MT	15 sec
MTGW	Glasgow, MT	1 sec	P055	Glendive, MT	15 sec
MTHC	Butte, MT	30 sec	P456	W. Yellowstone, MT	15 sec
MTHM	Harlem, MT	1 sec	<u>p457</u>	Big Sky, MT	--
MTLG	Lodge Grass, MT	1 sec	P458	W. Yellowstone, MT	15 sec
MTLO	Loma, MT	1 sec	P460	Big Sky, MT	--
MTLW	Lewistown, MT	1 sec	P461	Merriman, MT	--
MTMS	MSU N. Havre, MT	1 sec	P680	W. Yellowstone, MT	15 sec
MTOP	Opheim, MT	1 sec	P706	Dillon, MT	15 sec
MTPJ	Pendroy Junct., MT	1 sec	P707	Red Rock Lakes, MT	15 sec
<u>MTRC</u>	Sidney, MT	15 sec	<u>P712</u>	W. Yellowstone, MT	--
MTSU	MSU Bozeman, MT	5 sec	<u>P714</u>	Gardiner, MT	--
MTSY	Scobey, MT	1 sec	P719	Ennis, MT	--
MTUM	Sunset, MT	1 sec	<u>P721</u>	Silver Gate, MT	--
MTWP	Wolf Point, MT	1 sec	P722	Fishtail, MT	15 sec
MTZM	Zoteman, MT	1 sec	<u>P818</u>	Fishtail, MT	--
<u>MTMI</u>	Miles City, MT	15 sec	<u>P819</u>	Fishtail, MT	--
NOMT	Norris, MT	1 sec	MAWY	Mammoth, WY	--
<u>BKFB</u>	Browning, MT	--	RYA1	East Hope, ID	--
<u>FTPP</u>	Popular, MT	--	NDGR	Grenora, ND	--
<u>MTPO</u>	Fort Peck RES., MT	--	P024	Sunset Peak, ID	--
YBRA	Red lodge, MT	15 sec	P025	Bonnors Ferry, ID	--
BUEH	Lima, MT	15 sec	<i>STMY</i>	<i>St. Mary, MT</i>	1 sec
LCLN	Lincoln, MT	1 sec	<i>CSCD</i>	<i>Cascade, MT</i>	1 sec
TWSD	Townsend, MT	1 sec	<i>DUTN</i>	<i>Dutton, MT</i>	1 sec
DRLG	Deer Lodge, MT	1 sec	<i>LBby</i>	<i>Libby, MT</i>	1 sec
WTHL	Whitehall, MT	1 sec	<i>PLSN</i>	<i>Polson, MT</i>	1 sec
EUKA	Eureka, MT	1 sec	<i>SUPR</i>	<i>Superior, MT</i>	1 sec
P045	Dillon, MT	15 sec	<i>BTMR</i>	<i>Big Timber, MT</i>	1 sec

--" Information unavailable

Stations to be added are presented in italic

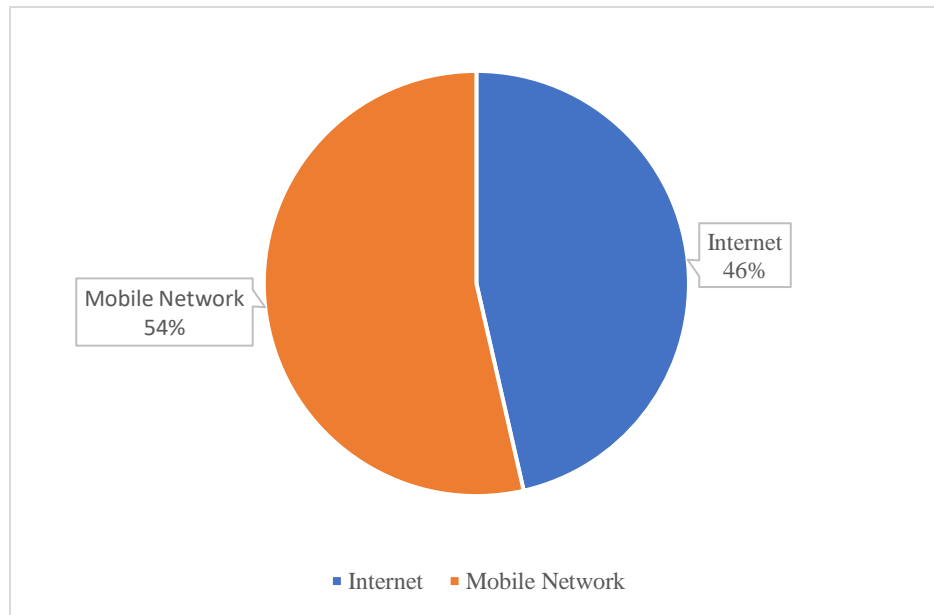


Figure 3. Type of Communication for Stations with Known Information in the MTSRN

3 SUMMARY

This task report discussed the current CORSs infrastructure in the state of Montana. This infrastructure is very important for planning the future statewide GNSS-RTN system in the state. Specifically, many of the existing CORSs have the potential of being incorporated in the statewide RTN network thus reducing the capital investment required for establishing the system. Overall, this task identified a total of 62 CORSs in Montana owned by both public and private entities. This report discussed the different RTN networks, both public and private, that Montana CORSs contribute to. Further, the report also summarized other important aspects of CORS operation such as CORS ownership, sampling rate, and type of communication.

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Appendix A: Montana CORSs Geospatial Location and Mounting Type

Montana CORs Geospatial Location and Mounting Type

Total Stations in Montana						
	Station	Location	Latitude	Longitude	Ellipsoid height (m)	Mounting Type
1	HAML	Hamilton, MT	46 11 42.80313 N	114 10 22.55733 W	1105.200m	Ground-based
2	LOLO	Lolo, MT	46 45 46.24771 N	114 05 48.67202 W	1109.859m	Ground-based
3	MSOL	Missoula Airport, MT	46 55 45.83764 N	114 06 31.84491 W	960.611m	Ground-based
4	MTBR	Bridger, MT	45 16 11.09210 N	108 54 51.42018 W	1106.667m	Ground-based
5	MTCB	Culbertson, MT	48 08 49.77412 N	104 30 11.22183 W	571.018m	Ground-based
6	MTCU	Cut Bank, MT	48 38 34.35059 N	112 18 58.49254 W	1134.073m	Ground-based
7	MTDT	Helena, MT	46 35 18.59145 N	111 59 36.96274 W	1217.743m	Ground-based
8	MTEI	Billings, MT	45 44 47.03568 N	108 36 00.73636 W	970.852m	Ground-based
9	MTFV	Flathead Valley CC, MT	48 13 38.89085 N	114 19 36.54279 W	905.671m	Roof-based
10	MTGW	Glasgow, MT	48 22 11.18755 N	106 47 36.41814 W	672.738m	Ground-based
11	MTHC	Butte, MT	45 56 16.19774 N	112 30 36.10882 W	1696.543m	Roof-based
12	MTHM	Harlem, MT	48 32 44.41440 N	108 46 46.76372 W	717.512m	Ground-based
13	MTLG	Lodge Grass, MT	45 18 44.66277 N	107 20 30.20525 W	1053.010m	Ground-based
14	MTLO	Loma, MT	47 57 02.41089 N	110 30 17.96950 W	835.250m	Ground-based
15	MTLW	Lewistown, MT	47 03 14.92966 N	109 26 33.76416 W	1236.960m	Ground-based
16	MTMS	MSU N. Havre, MT	48 32 27.42647 N	109 41 11.85839 W	773.908m	Roof-based
17	MTOP	Opheim, MT	48 51 17.11527 N	106 24 22.04353 W	980.556m	Ground-based
18	MTPJ	Pendroy Junct., MT	48 04 14.81121 N	112 20 09.16623 W	1310.411m	Ground-based
19	MTRC	Sidney, MT	47 42 38.17615 N	104 10 51.20554 W	584.659m	Ground-based
20	MTSU	MSU Bozeman, MT	45 39 40.37682 N	111 02 42.00897 W	1495.489m	Ground-based
21	MTSY	Scobey, MT	48 47 37.61523 N	105 23 55.55138 W	745.944m	Ground-based
22	MTUM	Sunset, MT	46 57 00.08260 N	113 28 20.62213 W	1122.778m	Roof-based
23	MTWP	Wolf Point, MT	48 05 58.09697 N	105 40 00.38540 W	617.360m	Ground-based
24	MTZM	Zoteman, MT	47 57 41.13086 N	108 18 18.92264 W	933.199m	Ground-based
25	MTMI	Miles City, MT	46 26 49.02766 N	105 47 48.62912 W	709.389m	Roof-based
26	NOMT	Norris, MT	45 35 48.6336 N	111 37 46.7118 W	1578.634m	Ground-based
27	BKFB	Browning, MT	48 32 56.35424 N	113 00 43.80884 W	1329.987m	Roof-based
28	FTPP	Popular, MT	48 06 56.40274 N	105 11 13.02263 W	595.395m	--
29	MTPO	Fort Peck RES.,MT	--	--	--	--
30	YBRA	Red lodge, MT	45 07 19.56 N	109 16 02.64 W	2072.518m	Ground-based
31	BUEH	Lima, MT	--	--	--	--
32	LCLN	Lincoln, MT	46 56 51.7196 N	112 44 34.8798 W	--	Ground-based
33	TWSD	Townsend, MT	46 18 34.1861 N	111 30 53.2971 W	--	Ground-based
34	DRLG	Deer Lodge, MT	46 23 19.4530 N	112 44 04.6286 W	--	Roof-based
35	WTHL	Whitehall, MT	--	--	--	Roof-based
36	EUKA	Eureka, MT	48 54 42.9881 N	115 03 19.7636 W	--	Roof-based
37	P045	Dillon, MT	45 22 58.32584 N	112 37 01.82863 W	1618.799m	Ground-based

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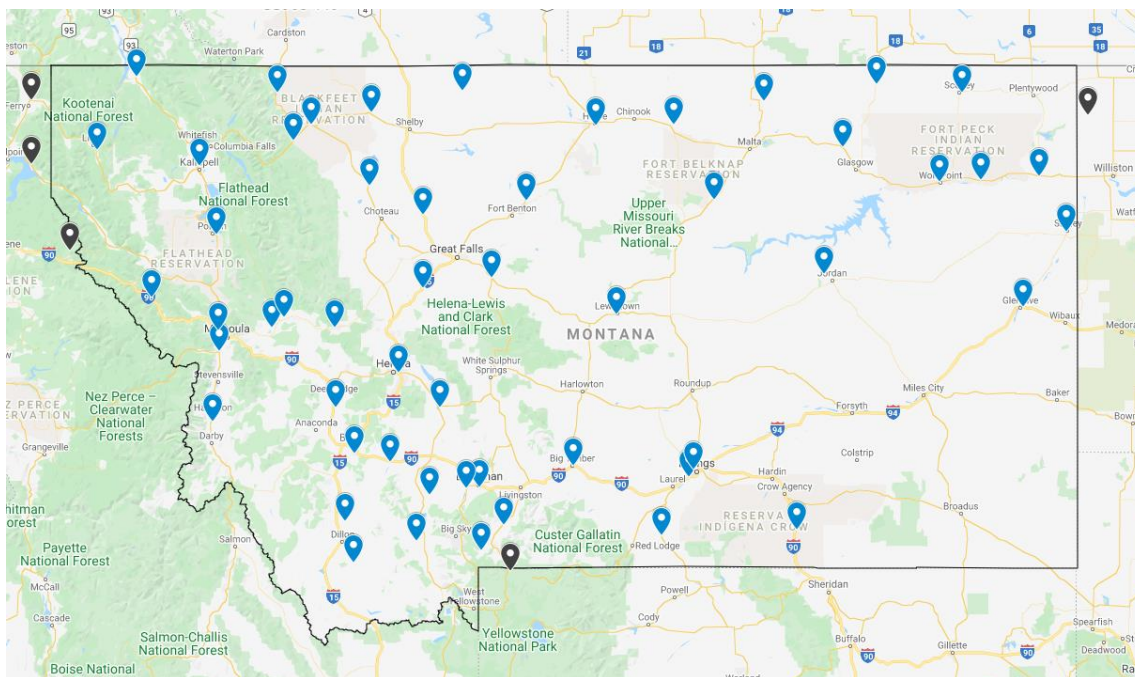
Total Stations in Montana - Continued						
	Station	Location	Latitude	Longitude	Ellipsoid height (m)	Mounting Type
38	P046	Clearwater Junct., MT	47 01 46.52357 N	113 19 54.18527 W	1290.844m	Ground-based
39	P047	East Glacier, MT	48 25 16.78905 N	113 13 11.02622 W	1476.057m	Ground-based
40	P048	Four Corners, MT	45 39 10.944 N	111 12 15.156 W	1492.595m	Ground-based
41	P049	Armington Junct., MT	47 20 59.85056 N	110 54 22.38306 W	1186.651m	Ground-based
42	P050	Sweat Grass Hills, MT	48 48 34.09690 N	111 14 54.29693 W	1267.434m	Ground-based
43	P051	Billings Airport, MT	45 48 23.74192 N	108 32 46.07076 W	1081.757m	Ground-based
44	P052	Jordan, MT	47 22 29.02686 N	107 01 07.18536 W	859.285m	Ground-based
45	P053	Whitewater, MT	48 43 33.86527 N	107 43 31.45675 W	815.608m	Ground-based
46	P054	Ekalaka, MT	45 50 46.83313 N	104 26 29.06244 W	1093.859m	Ground-based
47	P055	Glendive, MT	47 07 00.14491 N	104 41 06.39476 W	668.450m	Ground-based
48	P456	W. Yellowstone, MT	44 51 48.564 N	111 13 30.396 W	2956.339m	Ground-based
49	p457	Big Sky, MT	45 02 28.392 N	111 16 21.432 W	2262.54m	Ground-based
50	P458	W. Yellowstone, MT	44 45 56.484 N	111 18 05.436 W	2393.924m	Ground-based
51	P460	Big Sky, MT	45 08 23.964 N	111 01 42.924 W	2197.818m	Ground-based
52	P461	Merriman, MT	45 21 15.3 N	110 45 31.284 W	1544.094m	Ground-based
53	P680	W. Yellowstone, MT	44 35 54.096 N	111 05 55.50 W	2315.94m	Ground-based
54	P706	Dillon, MT	45 02 36.47248 N	112 31 26.66902 W	1811.325m	Ground-based
55	P707	Red Rock Lakes, MT	44 43 07.55322 N	111 50 13.73844 W	2293.445m	Ground-based
56	P712	W. Yellowstone, MT	44 57 26.892 N	111 04 20.568 W	2161.49m	Ground-based
57	P714	Gardiner, MT	44 53 45.06 N	110 44 39.912 W	2250.18m	Ground-based
58	P719	Ennis, MT	45 13 03.936 N	111 47 20.508 W	1706.356m	Ground-based
59	P721	Silver Gate, MT	45 00 10.638 N	110 00 07.38 W	2236.31m	Ground-based
60	P722	Fishtail, MT	45 27 25.98575 N	109 34 15.58671 W	1453.451m	Ground-based
61	P818	Fishtail, MT	45 27 26.424 N	109 34 15.636 W	1463.00m	Ground-based
62	P819	Fishtail, MT	45 27 26.208 N	109 34 16.14 W	1463.00m	Ground-based
63	MAWY	Mammoth, WY	44 58 24.31914 N	110 41 21.43320 W	1824.920m	Roof-based
64	RYA1	East Hope, ID	--	--	--	--
65	NDGR	Grenora, ND	48 37 14.47271 N	103 55 59.20221 W	642.775m	Roof-based
66	P024	Sunset Peak, ID	47 33 43.92 N	115 50 32.784 W	1907.629m	Ground-based
67	P025	Bonnors Ferry, ID	48 43 51.63211 N	116 17 14.98280 W	695.894m	Ground-based
68	STMY	<i>St. Mary, MT</i>	48 47 24.4521 N	113 24 28.4052 W	--	Ground-based
69	CSCD	<i>Cascade, MT</i>	47 15 39.8010 N	111 42 21.3293 W	--	Roof-based
70	DUTN	<i>Dutton, MT</i>	47 50 34.9700 N	111 42 24.4100 W	--	Roof-based
71	LBby	<i>Libby, MT</i>	48 21 04.7988 N	115 31 27.2496 W	--	Roof-based
72	PLSN	<i>Polson, MT</i>	47 41 09.4416 N	114 07 29.0496 W	--	Roof-based
73	SUPR	<i>Superior, MT</i>	47 11 13.8800 N	114 52 54.5600 W	--	Roof-based
74	BTMR	<i>Big Timber, MT</i>	45 50 19.9608 N	109 56 53.3796 W	--	Roof-based

-- Information unavailable

Stations to be added are presented in italic

Appendix B: Montana CORS Networks

MTSRN – CORSSs Map and Table

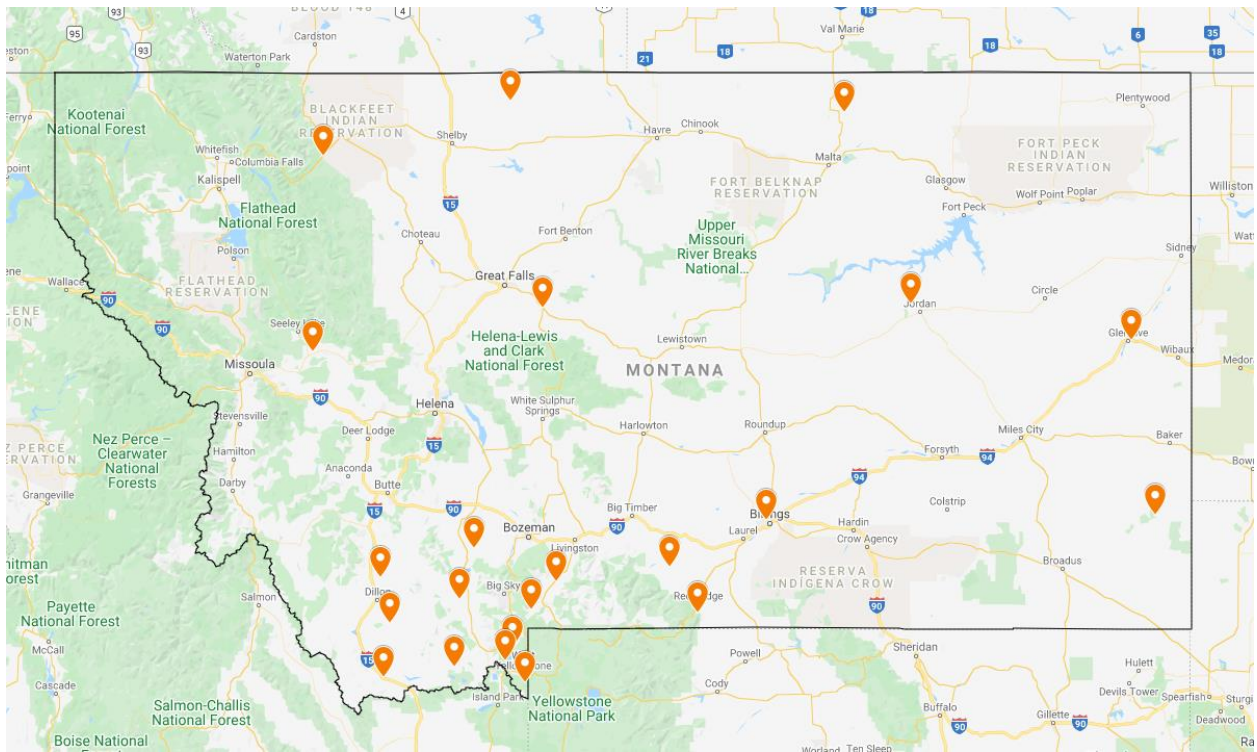


Stations in the MTSRN					
Station	Location	Station	Location	Station	Location
BKFB	Browning, MT	LCLN¹	Lincoln, MT	P051	Billings Airport, MT
FTPP	Popular, MT	TWSD¹	Townsend, MT	P052	Jordan, MT
HAML	Hamilton, MT	DRLG¹	Deer Lodge, MT	P053	Whitewater, MT
LOLO	Lolo, MT	WTHL¹	Whitehall, MT	P055	Glendive, MT
MSOL	Missoula Airport, MT	EUKA¹	Eureka, MT	P460	Big Sky, MT
MTBR	Bridger, MT	NOMT¹	Norris, MT	P461	Merriman, MT
MTCB	Culbertson, MT	MTRC	Sidney, MT	P706	Dillon, MT
MTCU	Cut Bank, MT	MTSU	Bozeman, MT	P719	Ennis, MT
MTDT	Helena, MT	MTSY	Scobey, MT	<i>STMY¹</i>	<i>St. Mary, MT</i>
MTEI	Billings, MT	MTUM	Sunset, MT	<i>CSCD¹</i>	<i>Cascade, MT</i>
MTFV	Flathead Valley CC, MT	MTWP	Wolf Point, MT	<i>DUTN¹</i>	<i>Dutton, MT</i>
MTGW	Glasgow, MT	MTZM	Zoteman, MT	<i>LBBY¹</i>	<i>Libby, MT</i>
MTHC	Butte, MT	NDGR	Grenora, ND	<i>PLSN¹</i>	<i>Polson, MT</i>
MTHM	Harlem, MT	P025	Sheridan, WY	<i>SUPR¹</i>	<i>Superior, MT</i>
MTLG	Lodge Grass, MT	P045	Dillon, MT	<i>BTMR¹</i>	<i>Big Timber, MT</i>
MTLO	Loma, MT	P046	Clearwater Junct., MT	MAWY	Mammoth, WY
MTLW	Lewistown, MT	P047	East Glacier, MT	RYA1¹	East Hope, ID
MTMS	MSU N. Havre, MT	P048	Four Corners, MT	NDGR	Grenora, ND
MTOP	Opheim, MT	P049	Armington Junct., MT	P024	Sunset Peak, ID
MTPJ	Pendroy Junct., MT	P050	Sweat Grass Hills, MT	P025	Bonnars Ferry, ID
MTPO¹	Fort Peck RES., MT				

Stations to be added are presented in italic

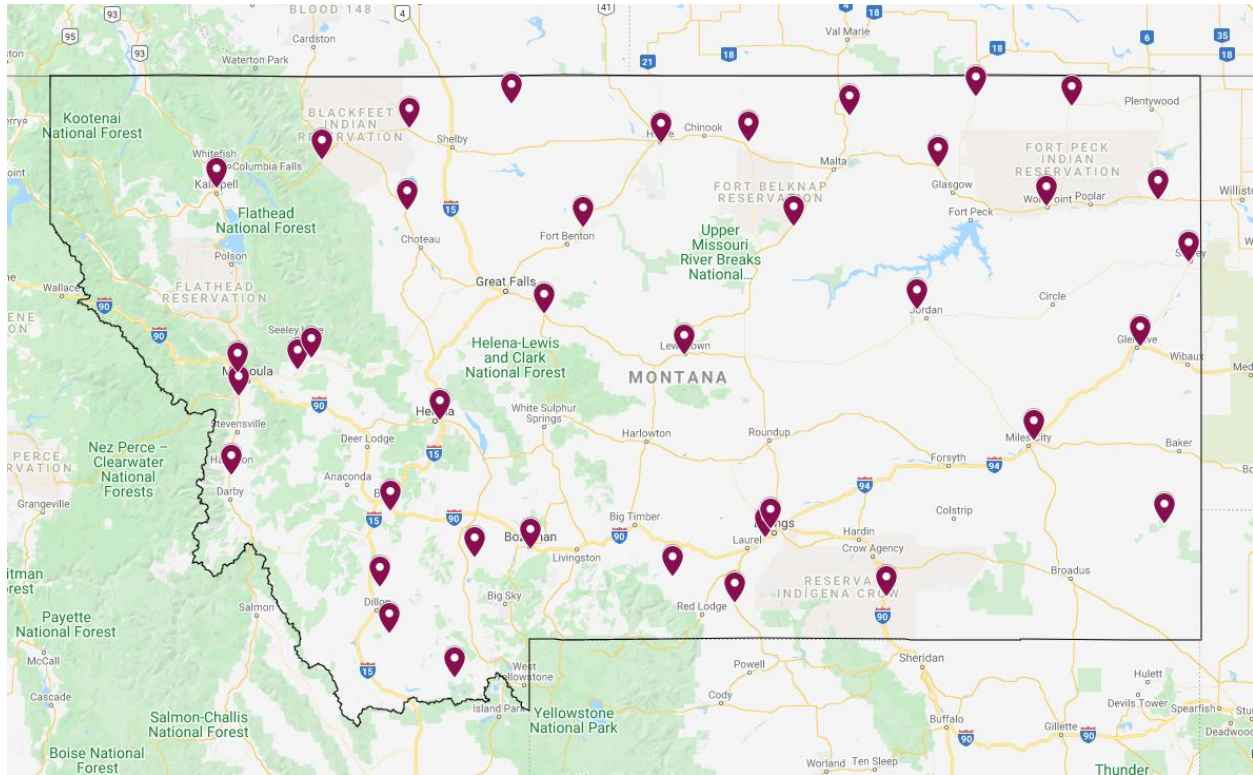
¹ Estimated location

UNAVCO – CORSs Map and Table



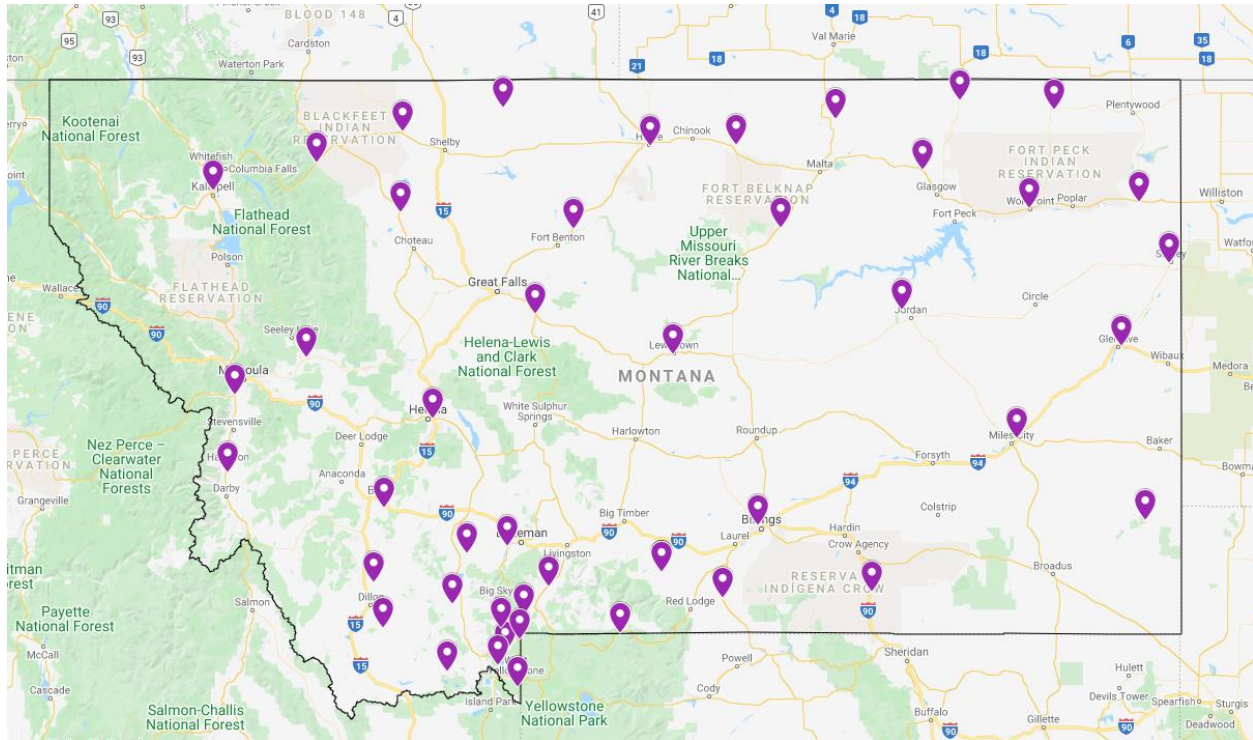
Montana CORSs - UNAVCO Network			
Station	Location	Station	Location
P045	Dillon, MT	P458	W. Yellowstone, MT
P046	Clearwater Junction, MT	P460	Big Sky, MT
P047	East Glacier, MT	P461	Merriman, MT
P049	Armington Junct., MT	P680	W. Yellowstone, MT
P050	Sweat Grass Hills, MT	P706	Dillon, MT
P051	Billings Airport, MT	P707	Red Rock Lakes, MT
P052	Jordan, MT	P719	Ennis, MT
P053	Whitewater, MT	P722	Fishtail, MT
P054	Ekalaka, MT	NOMT	Norris, MT
P055	Glendive, MT	YBRA	Red lodge, MT
P456	W. Yellowstone, MT	BUEH	Lima, MT

NCN – CORSSs Map and Table



Montana CORSSs - NCN					
Station	Location	Station	Location	Station	Location
HAML	Hamilton, MT	MTLO	Loma, MT	P047	East Glacier, MT
LOLO	Lolo, MT	MTLW	Lewistown, MT	P049	Armington Junct., MT
MSOL	Missoula Airport, MT	MTMS	MSU N. Havre, MT	P050	Sweat Grass Hills, MT
MTBR	Bridger, MT	MTOP	Opheim, MT	P051	Billings Airport, MT
MTCB	Culbertson, MT	MTPJ	Pendroy Junct., MT	P052	Jordan, MT
MTCU	Cut Bank, MT	MTRC	Sidney, MT	P053	Whitewater, MT
MTDT	Helena, MT	MTSU	MSU Bozeman, MT	P055	Glendive, MT
MTEI	Billings, MT	MTSY	Scobey, MT	P706	Dillon, MT
MTFV	Flathead Valley CC, MT	MTUM	Sunset, MT	P707	Red Rock Lakes, MT
MTGW	Glasgow, MT	MTWP	Wolf Point, MT	P054	Ekalaka, MT
MTHC	Butte, MT	MTZM	Zoteman, MT	MTMI	Miles City, MT
MTHM	Harlem, MT	P045	Dillon, MT	P722	Fishtail, MT
MTLG	Lodge Grass, MT	P046	Clearwater Junct., MT	NOMT	Norris, MT

TRIMBLE – CORSSs Map and Table



Montana CORSSs - Trimble's Network					
Station	Location	Station	Location	Station	Location
HAML	Hamilton, MT	MTRC	Sidney, MT	P055	Glendive, MT
LOLO	Lolo, MT	MTSY	Scobey, MT	P456	W. Yellowstone, MT
MTBR	Bridger, MT	MTWP	Wolf Point, MT	p457	Big Sky, MT
MTCB	Culbertson, MT	MTZM	Zortman, MT	P458	W. Yellowstone, MT
MTCU	Cut Bank, MT	MTMI	Miles City, MT	P460	Big Sky, MT
MTDT	Helena, MT	NOMT	Norris, MT	P461	Merriman, MT
MTFV	Flathead Valley CC, MT	P045	Dillon, MT	P680	W. Yellowstone, MT
MTGW	Glasgow, MT	P046	Clearwater Junct., MT	P706	Dillon, MT
MTHC	Butte, MT	P047	East Glacier, MT	P707	Red Rock Lakes, MT
MTHM	Harlem, MT	P048	Four Corners, MT	P712	W. Yellowstone, MT
MTLG	Lodge Grass, MT	P049	Armington Junct., MT	P719	Ennis, MT
MTLO	Loma, MT	P050	Sweat Grass Hills, MT	P721	Silver Gate, MT
MTLW	Lewistown, MT	P051	Billings Airport, MT	P722	Fishtail, MT
MTMS	MSU N. Havre, MT	P052	Jordan, MT	P818	Fishtail, MT
MTOP	Opheim, MT	P053	Whitewater, MT	P819	Fishtail, MT
MTPJ	Pendroy Junct., MT	P054	Ekalaka, MT		